2017
California Forest Pest Conditions

A publication of the
California Forest Pest Council

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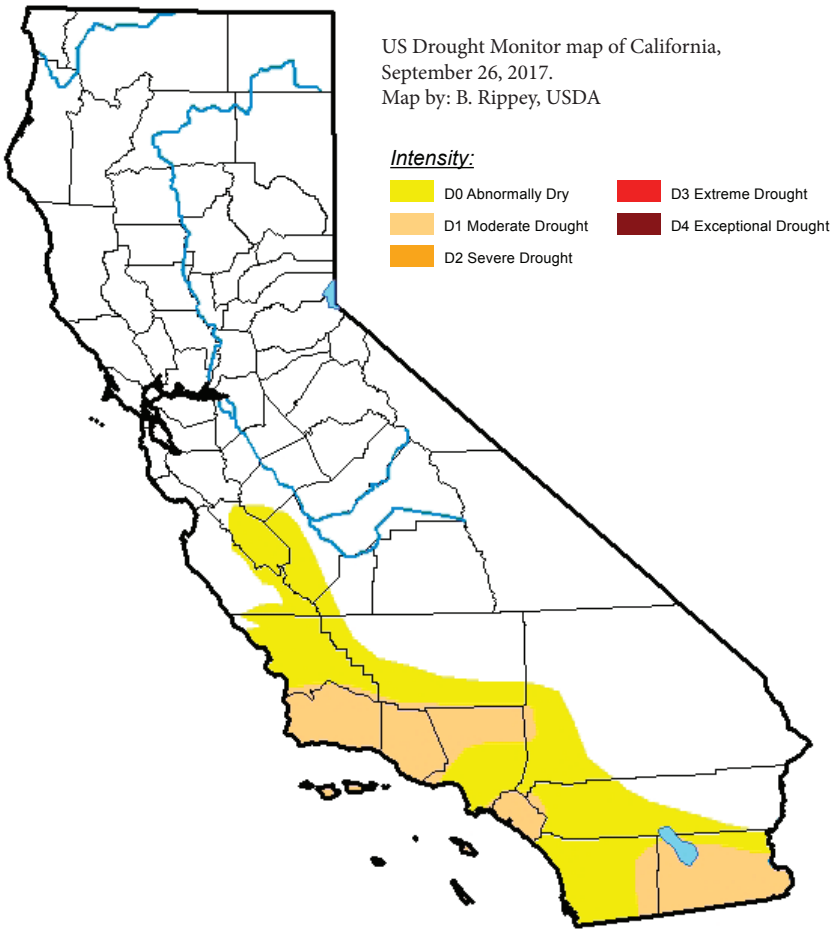
California's statewide precipitation was well above average (+12.09 in) in 2017, making it the 5th wettest water year on record (since January 1895) and the wettest year since 1998. Most rainfall occurred in October 2016 and January and February 2017 (the water year is from October 1 – September 30). The April 1, 2017 statewide snowpack was 164% of average, up from 86% of average in 2016, and the highest since 2011, when it was 171% of average.

California experienced its fourth warmest year on record (since January 1895) in 2017, with August being the warmest month on record (4.1 degrees above average). July 2017 was the third warmest.

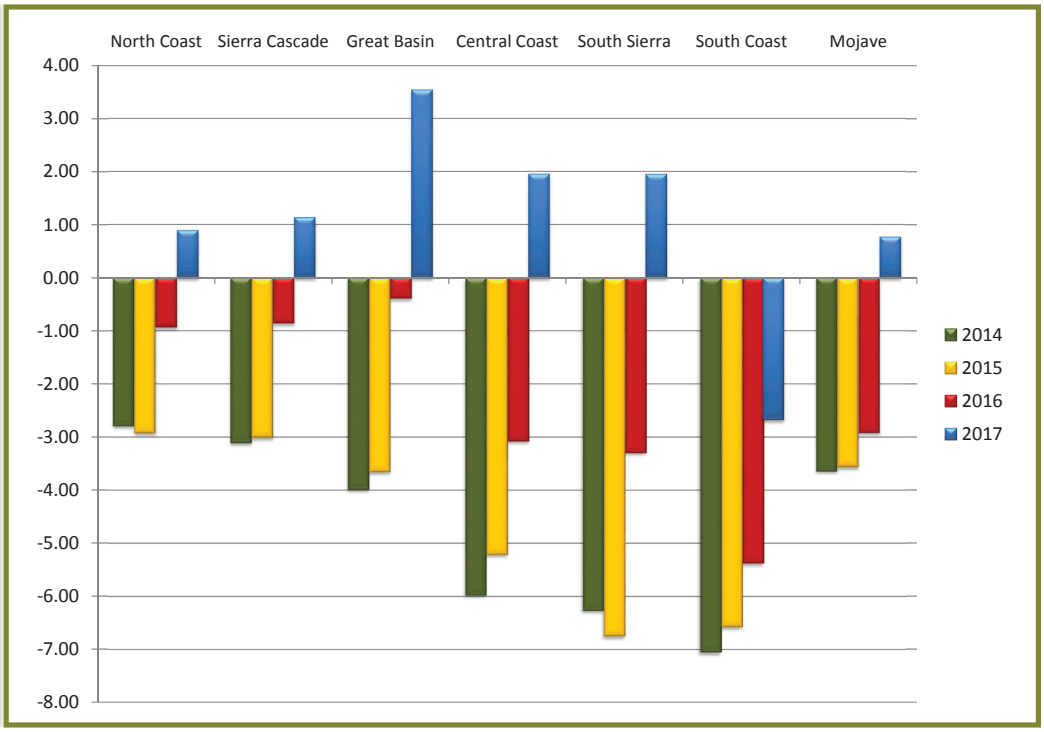
Impacts from the 5-year drought, overstocked forests, and higher than average temperatures were the most significant factors affecting California forest health in 2017, with 27 million dead trees mapped across 2.5 million acres during the USDA Forest Service forest health aerial detection surveys. More than 47% of the dead trees were on the Sequoia, Stanislaus, and Sierra National Forests. Statewide, 5,762 fires consumed 147,373 acres, killing millions of trees and leaving millions more weakened.



US Drought Monitor map of California, September 26, 2017.
Map by: B. Rippey, USDA

Palmer Drought Index

The Palmer Drought Index is an indicator of drought and moisture excess, with negative values denoting degree of drought. In 2017, the yearly average Palmer Drought Index values ranged from 3.5 in the Great Basin (wettest zone) to -2.7 in the South Coast (driest zone).

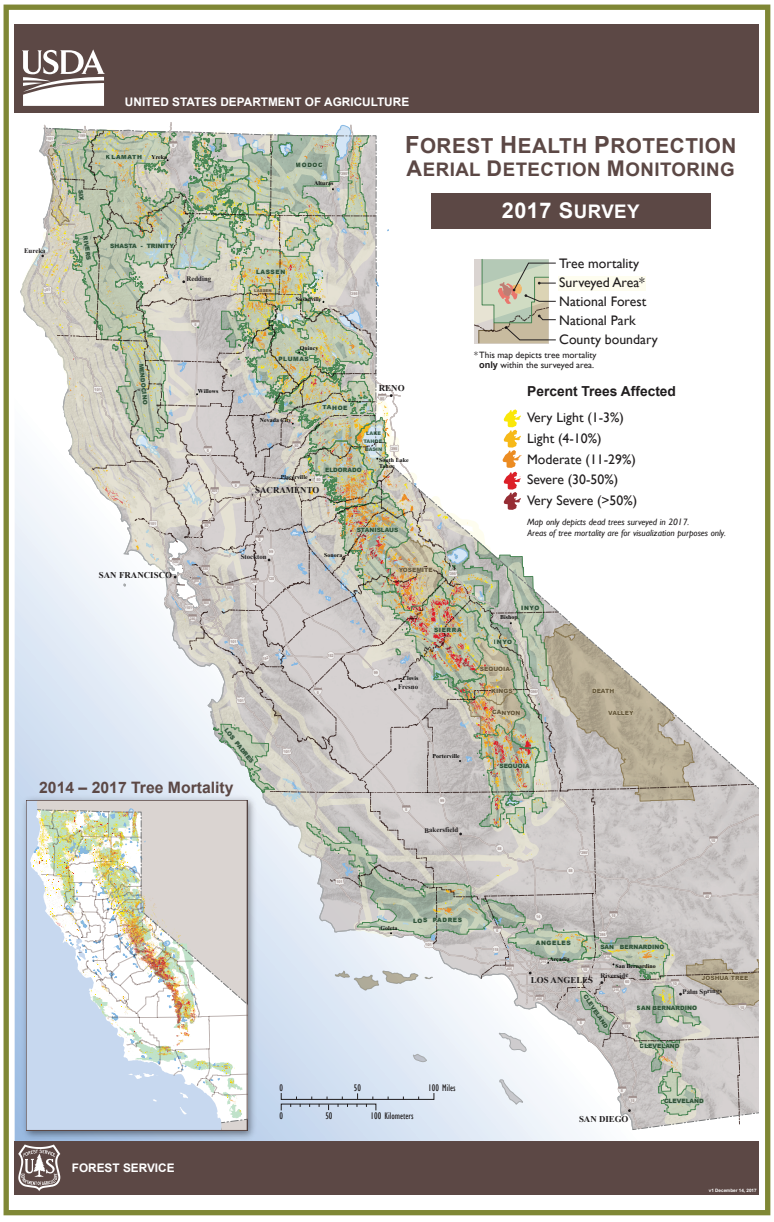


USDA Forest Service Pacific Southwest Region State and Private Forestry conducts annual aerial surveys throughout forested areas of California to detect recent tree mortality, tree decline, and defoliation. Surveys are flown in small, fixed-wing aircraft on a 4-mile grid pattern with two observers recording tree health condition and extent on mobile computing devices for their respective side of the plane. All National Forests and forested National Parks are typically surveyed, along with other federal, state, and private lands.

New survey devices were utilized in 2017 which use a different recording protocol and data structure than previous surveys. Every effort was made to make the new system compatible with legacy aerial survey data. Due to unexpected aircraft maintenance issues and extensive fires and smoke over much of the summer, the 2017 aerial survey was not completed until mid-November. To accommodate the tight timeline, flight lines were generally more widely spaced and some areas were not flown.

On the 40 million acres surveyed in 2017, approximately 27 million new dead trees were detected across approximately 2.5 million acres. While 2017 tree mortality was less than half the 62 million dead trees recorded in 2016, it was still well above typical annual mortality levels (~ 1 million trees statewide). Mortality was primarily attributed to the preceding 5-year drought event and subsequent successful attacks by bark beetles, which collectively resulted in an estimated 129 million dead trees from 2010-2017.

On the west side of the southern Sierra Nevada range where the drought was most extreme, pine mortality was not as prevalent in 2017, as a majority of pines were killed in previous years in many locations. Tree mortality detected in 2017 was predominantly in white and California red fir and was at moderate to severe levels at all elevations, even in the highest, most remote areas. In the northern Sierra Nevada range, fir mortality at lower and mid-elevations was abundant but less intense and closely correlated with overly dense stand conditions.



USDA FS Aerial Detection Survey, Tree Mortality, 2017.
Map by: A. Ellis, USDA FS

Acres reported below may be noted in more than 1 bullet as multiple agents often occur in the same location. Additionally, although acres reported had some elevated level of mortality detected, not all host trees in any given area were killed.

Bark Beetles and Wood Borers

- Almost 2.5 million acres of CA forestland contained elevated levels of bark beetle or wood borer activity (similar to 2015 levels). This was down from over 4 million acres in 2016. Pine mortality within these areas was also generally less intense.
- Mortality of incense cedar, sugar pine, and other conifer species was uncommon, but it was likely underrepresented due to the difficulty of detecting single trees and limitations in the new recording equipment.
- Fir engraver-related white and red fir mortality was estimated at almost 22 million trees and accounted for 88% of all new mortality. Tree mortality spanned approximately 2 million acres, a reduction from the 2.65 million acres recorded in 2016.
- Western pine beetle-related mortality, in primarily ponderosa pine, was drastically reduced from over 2.4 million acres in 2016 to 330,000 acres in 2017, but western pine beetle still killed more than 3 million trees.
- Mountain pine beetle activity was identified on 113,000 acres (down from 1.1 million acres in 2016) and caused mortality of

more than 600,000 trees.

- Jeffrey pine beetle activity was estimated at more than 700,000 trees killed across 139,000 acres, down from 500,000 acres in 2016. (Note: A more rigorous review greatly decreased the area of Jeffrey pine beetle activity reported back to 2015 as ground verification indicated the host type was ponderosa pine, not Jeffrey pine; however, total mortality was unchanged.)
- *Ips*-related pinyon pine mortality continued to decline from 30,000 affected acres recorded in 2016 to 18,000 acres and approximately 47,000 trees killed in 2017.
- Gray pine mortality was low, with less than 1,000 trees killed across 125 acres, down from 6,700 acres in 2016; however, less of this area was surveyed in 2017 due to flight constraints.
- Coulter pine mortality decreased from 18,000 acres in 2016 to just over 7,000 acres in 2017, with an estimated 40,000 trees killed.
- Mortality in larger Douglas-fir not attributed to feeding by bears decreased from 31,000 acres in 2016 to 18,000 acres in 2017.
- Oak mortality attributed to goldspotted oak borer (GSOB) in San Diego County decreased from 11,000 trees over 7,000 acres in 2016 to 4,000 trees over 5,700 acres in 2017.
- Oak mortality not attributed to GSOB also decreased from 98,000 acres to less than 3,000 acres; however, it was difficult to differentiate between recent and older mortality. Older mortality was common in many areas where drought had been more severe.

High elevation areas in the central and southern Sierra Nevada range, such as here within Yosemite NP, typically had landscape level moderate intensity mortality of mostly California red fir. Notice the smoky conditions which often hampered survey efforts. Photo by: J. Moore, USDA FS

Area on the Sierra NF typical of the mixed conifer habitat type in the central and southern Sierra Nevada range. Notice most of the recent mortality is white fir and that the giant sequoia grove in the lower left still looks healthy. Photo by: J. Moore, USDA FS

Defoliation/Dieback

- Surviving oaks in all areas looked healthy for the first time in years, a testament to their resiliency. Resprouting was also evident in interior live oak and deciduous oak species in many areas with previously recorded canopy dieback and tree mortality.
- Aspen defoliation was minor in areas previously impacted by satin moth and Marssonina leaf blight.

Diseases

- Mortality attributed to *Phytophthora ramorum*/sudden oak death was estimated at over 21,000 trees across 17,400 acres, an increase from over 10,500 acres in 2016, but still much lower than historical norms. Drought conditions in recent years have inhibited pathogen spread.

Collaborative Project by:

- USFS R5 SPF Forest Health Protection
- USFS Forest Health Technology Enterprise Team
- CAL FIRE
- CA Forest Pest Council

The Forest Pest Observation Database (FPODA) serves as the primary repository for all forest pest observations in California. Historically, pest observations were captured through a combination of the annual California Forest Pest Conditions Report and documented using Pest Detection Reports (PDRs). While these methods captured the information, they were not easily accessed or searchable. FPODA is a fully searchable (by pest, host, and location) web-based application that is accessible to land managers and the public.

Data entry is currently restricted to forest health professionals from state and federal agencies. Public and private land managers may submit reports to forest health contacts for database entry. A new pest detection mobile application for data entry will be available in May 2018.

This map shows the locations of pest observations made by forest health professionals in 2017. The most frequently reported pests were bacterial leaf scorch, fir engraver, and white pine blister rust. The most frequently reported host species were ponderosa pine, sweetgum, Jeffrey pine, and Douglas-fir.

Native Insects

California Fivespined Ips (*Ips paraconfusus*)

Groups of Torrey pine (*Pinus torreyana*) mortality caused by *Ips* and drought were identified in North Tustin/ Cowan Heights in Orange County.

Torrey pine mortality. Photo by: Darren Smith, CA State Parks, San Diego County

Torrey Pine State Park (San Diego County) also experienced significant Torrey pine mortality, with approximately 100 trees killed by California fivespined ips and red turpentine beetle (*Dendroctonus valens*) infestations.

Torrey pine dieback. Photo by: Stacy Schenkel, OC Public Works, Orange County

Douglas-fir Beetle (*Dendroctonus pseudotsugae*)

Two to 3 large groups (~50 trees each) of Douglas-fir beetle-caused mortality were observed south of Lake Almanor on the Plumas National Forest (Plumas County). These were some of the only mature Douglas-fir (*Psuedotsuga menziesii*)-dominated pockets in this mixed-conifer area. Scattered Douglas-fir growing in adjacent mixed-conifer stands were not attacked. All mortality was located within a low severity burn area of the 2012 Chips Fire.

Douglas-fir mortality caused by Douglas-fir beetle, Plumas NF . Photo by: D. Cluck, USDA FS

Galleries of Douglas-fir beetle inside bark of windthrown Douglas-fir trees along the South Fork of the Smith River, Del Norte County. Photo by Chris Lee, CALFIRE

Fresh galleries constructed by Douglas-fir beetle were observed on windthrown large-diameter Douglas-fir trees on a privately-owned parcel near the intersection of South Fork Road and the G-O Road, along the South Fork Smith River (Del Norte County). The galleries were found on many downed trees throughout the ~1.5 acres of windthrow, which occurred in late winter (February-March) 2017.

Douglas-fir Tussock Moth (*Orgyia pseudotsugata*)

Douglas-fir tussock moth trap catches remained low (<25 moths/trap) throughout most of the Sierra Nevada and Cascade ranges. The one exception was on the Big Valley Ranger District, Modoc National Forest (Modoc and Lassen Counties), where 2 trap lines averaged >25 moths/trap. Follow-up larval surveys will be conducted in spring 2018 at these sites. No defoliation was reported.

Fir engraver beetle galleries on dead white fir in Methodist Camp, Shasta-Trinity NF. Photo by: C. Snyder, USDA FS

Fir Engraver (*Scolytus ventralis*)

In northwestern California, fir engraver beetle caused scattered mortality in low- to mid-elevation white fir (*Abies concolor*), especially in stands that were historically pine. Several groups of 3-6 dead trees were found in the Harlan plantations near Mount Hebron on the Klamath National Forest

Fir engraver beetle-caused mortality of white fir, Lassen NF.
Photo by: D. Cluck, USDA FS

Fir engraver beetle-caused white fir mortality, Lassen NF.
Photo by: D. Cluck, USDA FS

and the Methodist Campground on the Shasta-Trinity National Forest (Siskiyou County).

Fir engraver beetle attacked large numbers of mature (40-50" DBH) red fir (*Abies magnifica*) at the summit of Brushy Mountain in the Trinity Alps Wilderness, southeast of the community of Denny (Trinity County). The crowns of these trees began to fade in early October. About 85-90% of the trees showed large amounts of boring dust on the boles, but no pitch streamers. Injuries from two fires within the last decade have affected tree health in this 60-acre area.

White fir mortality continued at elevated levels in northeastern California (thousands of trees over several thousand acres) as a result of 2016 fir engraver beetle attacks. However, emerging beetles found fewer susceptible trees to attack, and many of the trees that were attacked exhibited high levels of pitch streaming. This pattern of unsuccessful attacks with the return of abundant soil moisture is similar to past white fir mortality events in northeastern California. Areas with very high levels of white fir mortality (approximately 30-40% dead) included the Warner Mountains and Manzanita Mountain, Modoc National Forest (Modoc County); Harvey Mountain, Lassen National Forest (Lassen County); and Verdi Peak, Tahoe National Forest (Sierra County).

In 2017, white and red fir mortality in the southern Sierra Nevada range (El Dorado, Amador, Calaveras, Tuolumne, Mariposa, Madera, Fresno, Tulare, Kings, Kern, Alpine, Mono, and Inyo Counties) approached 2016 ponderosa pine (*Pinus ponderosa*) mortality levels. True firs continued to be impacted by engravers (*Scolytus* spp.), wood borers, and pathogens such as Heterobasidion root disease (*Heterobasidion occidentale*). Fir engraver beetle attacks were found in multiple stand conditions and tree diameters. Pitch flow associated with attacks on firs was high. Fir engraver attacks were typically accompanied by wood borers in large diameter trees (>20 in). Along Highway 108 on the Stanislaus National Forest (Tuolumne County), recent and older fir mortality was associated with root disease infection centers. Red fir mortality on the east side of the Sierra Nevada range (Mono County) caused many homeowners to call local forest managers asking about options for saving trees. Unfortunately, many trees were already dead and had to be removed. Between June Lake and Mammoth Lakes (Mono County), red fir

Fir engraver beetle-caused mortality of fir trees, Cold Springs, Stanislaus NF. Photo by: B. Bulaon, USDA FS

White and red fir mortality behind homes in June Lake.
Photo by: Henry Herrera, CALFIRE, Mono County

mortality occurred at a rate of 3-6 trees per acre. Above 8,500 ft in elevation, fir engraver activity in red fir stands was minimal, but top kill was still noted in some of the largest trees. The few 2017 attacks observed occurred mostly in small trees (<11 in DBH). Red fir mortality levels on the west side of the Sierra Nevada range were similar to conditions on the east side and were associated with root disease pockets as well as Indian paint fungus (*Enchinodontium tinctorium*).

Inyo County also experienced large numbers of dying white and red fir as a result of drought and fir engraver beetle. Attacks resulted in top-kill, dead patches on the bole, and tree death.

Very light to moderate fir engraver beetle activity (<10 trees per acre) was observed on Mount Lewis and along the north side of the Angeles Crest Highway, northwest of Blue Ridge on the Angeles National Forest (Los Angeles County). Ground surveys confirmed Heterobasidion root disease and fir engraver activity in Barton Flats on the San Bernardino National Forest (San Bernardino County) where white fir mortality was estimated to be 10 trees per acre.

Jeffrey pine attacked by Jeffrey pine beetle, Lassen NF. Photo by: D. Cluck, USDA FS

Ips spp.

Pine engraver beetles (*Ips pini*) were found in the upper boles and larger limbs of 5 Jeffrey pines (*Pinus jeffreyi*) that were attacked by Jeffrey pine beetle (*Dendroctonus jeffreyi*) on the Lassen National Forest, 3 near Lassen Volcanic National Park (Shasta County) and 2 on Harvey Mountain (Lassen County) as well as in Jeffrey pine that were attacked by California flatheaded borer (*Phaenops californica*) (~40 trees) just north of Susanville (Lassen County).

Scattered Jeffrey pine mortality in smaller diameter trees at lower elevations continued on national forest land in Southern California. Most of the mortality was associated with *Ips* spp. Mortality was observed on Laguna Mountain (Cleveland National Forest, San Diego County) and Frazier Mountain (Los Padres National Forest, Ventura County) in small isolated pockets (<10 trees per acre).

Jeffrey Pine Beetle (*Dendroctonus jeffreyi*)

Jeffrey pine beetle-caused Jeffrey pine mortality remained at low levels throughout northeastern California. Five large-diameter attacked trees were found on the Lassen National Forest, 3 near Lassen Volcanic National Park (Shasta County) and 2 on Harvey Mountain (Lassen County).

Increasing Jeffrey pine beetle-caused mortality was reported around Inyo Craters and Deadman and Glass Creek Roads on the Mammoth Lake Ranger District, Inyo National Forest (Mono County). Several small groups (2-5 trees) of green-infested trees were noted by marking crews. Attacked trees were >20 inches DBH on average.

Jeffrey pine mortality (<10 trees per acre) was scattered across natural stands from Lake Arrowhead east to Big Bear Lake and south to Barton Flats on the San Bernardino National Forest (San Bernardino County).

Mountain Pine Beetle (*Dendroctonus ponderosae*)

Successful mountain pine beetle attacks were noted on lodgepole (*Pinus contorta*), sugar (*Pinus lambertiana*), and ponderosa pine in northeastern California, but overall mortality was much lower than in prior years. Individual and small groups (2-4 trees) of attacked trees were noted on the Lassen National Forest near Bogard Buttes (Lassen County) and Ashpan Snowmobile Park (Shasta County).

Individual large diameter sugar pines (>30 in) and trees in small groups (3-10 trees) continued to die in southern Sierra Nevada forests. Areas along Ellis Road and Panther Creek on the Eldorado National Forest (Amador County)

Large pitch tubes associated with mountain pine beetle attacks on ponderosa pine, Lassen NF. Photo by: D. Cluck, USDA FS

Red turpentine beetle-attacked tree in the Railroad Fire area, Sierra NF. Photo by: B. Bulaon, USDA FS

Western pine beetle-caused mortality in ponderosa pine at Harlan plantations, Klamath NF. Photo by: C. Snyder, USDA FS

Western pine beetle-caused mortality in fire-injured ponderosa pine in Middle Creeak drainage, Klamath NF. Photo by: C. Snyder, USDA FS

included dead sugar pines within or near dead groups of ponderosa pines. Attacks in ponderosa pine were combinations of mountain and western pine beetle (*Dendroctonus brevicomis*). Groups of dead lodgepole pine (5-15 trees) were detected in Inyo Craters on the Inyo National Forest (Mono County), near the edges of dry meadows or along roadsides where tree density was very high compared to interior stands. Around Huntington Lake on the Sierra National Forest (Fresno County), large groups (20-50 trees) of dead lodgepole pine were observed along Highway 168 near powerlines and privately-owned camps. Mountain pine beetle activity appeared to be increasing in these areas.

Significant sugar pine mortality also occurred in Angelus Oaks (San Bernardino County).

Fire-injured ponderosa pine (fire in 2014) attacked by western pine beetle in 2015-2017. Photo by: C. Snyder, USDA FS

Red Turpentine Beetle (*Dendroctonus valens*)

Red turpentine beetle attacks continued on Monterey (*Pinus radiata*) and bishop pines (*Pinus muricata*) in Humboldt County. Many of these attacks were associated with whole-tree mortality and are presumed to be a legacy of long-term drought conditions. Most attacks were accompanied by stain fungi such as *Leptographium* spp.; collections of these fungi, as well as characterization of their "blue-stain" (invasion of xylem tissues through ray cells) versus "black-stain" (causation of wilt via rapid invasion of primarily outer xylem) habits, are ongoing.

Red turpentine beetles were observed infesting fire-injured trees in areas with recent wildfires on the Sierra, Stanislaus, and Sequoia National Forests. An evaluation of ponderosa pines in the Railroad Fire (Sierra National Forest, Madera County), found high levels of red turpentine beetle attacks, but no attacks by western pine beetle.

Large diameter, fire-killed pines in high-intensity burned areas of the 2016 Cedar Fire (Sequoia National Forest, Kern County) were attacked by red turpentine beetles in spring 2017.

Many trees that survived drought or fire in the southern Sierra Nevada forests were noted with high numbers of red turpentine beetle pitch tubes in 2017, indicating trees remained stressed.

Western Pine Beetle (*Dendroctonus brevicomis*)

Mortality caused by western pine beetle was lower in 2017 across northwestern California, but small groups of dead trees were noted in overstocked ponderosa pine plantations. Groups of 1-5 dead trees were scattered across lower-elevation pine stands on the Shasta-Trinity National Forest, including in the McBride Plantation surrounding the communities of Mount Shasta and McCloud Flats (Siskiyou County). Similar mortality was observed in ponderosa pine plantations surrounding Mt. Hebron on the Klamath National Forest (Siskiyou County). Western pine beetle also caused mortality in groups of 10-30 trees in lightly to moderately burned areas in the Middle Creek drainage on the Klamath National Forest (Siskiyou County).

Western pine beetle-caused mortality in fire-injured ponderosa pine (fire in 2014) in Middle Creek drainage, Klamath NF.
Photo by: C. Snyder, USDA FS

The number of ponderosa pine killed by western pine beetle also declined sharply this year in northeastern California. Most of the ponderosa pine mortality observed in 2017 was the result of late 2016 attacks. Many trees that were attacked in May and June 2017 responded with large amounts of resin, resulting in numerous unsuccessful attacks (pitch outs) and unsuccessful gallery formation when adult beetles were able to penetrate the bark. Consequently, tree mortality caused by adults from the overwintering population as well as the subsequent second generation diminished. The lowest elevational range of ponderosa pine had a third generation of beetles emerge in September. Larger groups (8-12 trees) of western pine beetle-killed ponderosa pine were observed on the Lassen National Forest near Lake Britton (Shasta County) and Blacks Mountain Experimental Forest (Lassen County) and near Sugar Pine Reservoir on the Tahoe National Forest (Placer County).

In the southern Sierra Nevada range, ponderosa pine mortality associated with western pine beetle declined significantly in 2017, particularly in counties that had local emergency declarations. New mortality was mostly along the fringes of older mortality groups or areas with poor site conditions (e.g. lava caps, steep south-facing slopes, etc.). Mortality of large diameter pines (>30 in) along Bass Lake (Madera County) continued but affected fewer trees than in previous years (1-3 trees/acre). Young pines in plantations on the Sierra and Stanislaus National Forests were attacked by western pine beetle and California fivespined ips. Only individual trees were attacked this year versus entire plantations being infested in prior years. Land managers and scientists looking for infested trees had difficulty finding new attacks in these areas.

Western pine beetle group kill of ponderosa pine, Lassen NF. Photo by: D. Cluck, USDA FS

Continuing but declining western pine beetle activity at Sugar Pine Reservoir, Tahoe NF.
Photo by: D. Cluck, USDA FS

Adult western pine beetle fighting resin flow, Lassen NF. Photo by: D. Cluck, USDA FS

Western pine beetle galleries with bluestain, Lassen NF. Photo by: D. Cluck, USDA FS

Insect Conditions

Western pine beetle-caused mortality of ponderosa pine at Alta Penny Pines plantation, Sequoia NF. Photo by: B. Bulaon, USDA FS

Western pine beetle-caused mortality of ponderosa pine at Alta Penny Pines plantation, Sequoia NF. Photo by: B. Bulaon, USDA FS

Western pine beetle killed over 300 ponderosa pines in the Alta Penny Pines Plantation on the Sequoia National Forest (Kern County). Mortality was nearly 100% in stands where tree spacing averaged 12x12 ft, compared to almost no mortality in an adjacent, more widely spaced stand. Several plantations on Hume Lake Ranger District of the Sequoia National Forest (Fresno County), along Forest Service Road 14S02, also experienced various levels of ponderosa pine mortality caused by western pine beetle where trees were dense.

In San Bernardino County, western pine beetle killed single trees and groups of 10-15 ponderosa and Coulter pine (*Pinus coulteri*) north of the mountain community of Crestline along Highway 138.

Bark beetle infestation near Crestline, CA. Photo by: Henry Herrera, CALFIRE, San Bernardino County

Invasive Insects

Asian Gypsy Moth (*Lymantria dispar asiatica*, a subspecies of European gypsy moth)

One Asian gypsy moth was found in Santa Cruz in August in a pest detection trap at a residential property. In response to the detection, additional traps were set throughout the city and the surrounding region in a cooperative effort with the United States Department of Agriculture (USDA), the California Department of Food and Agriculture, and the Agricultural Commissioner's office. The trapping array was designed to determine the presence and extent of any infestation.

If an infestation were to develop in the Santa Cruz region, Asian gypsy moth caterpillars could threaten nearby forests and local oaks as well as many other hardwoods, evergreens, manzanita, cottonwood, willow, and other species. Asian gypsy moths are also a threat to agricultural crops such as fruit trees. If trapping efforts determine that an infestation exists, the USDA will convene a Technical Working Group of scientists and experts to assess the situation and determine next steps.

European Gypsy Moth (*Lymantria dispar*)

One male European gypsy moth was found in a trap near Soquel (Santa Cruz County) in August. There were also 9 detections of various life stages at border stations or during follow-up inspections by county officials of material that had entered the state.

Goldspotted Oak Borer (*Agrilus auroguttatus*)

Goldspotted oak borer (GSOB) was detected for the first time on the Trabuco Ranger District, Cleveland National Forest. GSOB-related injury was found on large diameter coast live oaks between Falcon and Blue Jay Campgrounds (Orange County). This new infestation is most likely the result of multiple introductions via GSOB-infested firewood to the area. No other new GSOB infestations were identified in 2017. Management of previously discovered infestations are ongoing in San Diego, Orange, Riverside, and Los Angeles Counties. In San Diego County, where the GSOB infestation in California was first discovered, oak mortality continued to occur with moderate (11-29%) to especially severe (30-50%) oak mortality on Palomar Mountain and

A tub grinder was used to manage goldspotted oak borer-infested trees around Green Valley Community Center on the Angeles NF. Grinding or chipping beetle-infested trees is one management option to reduce the potential for spread.
Photo by: V. Zukauskas, USDA FS

Protecting highly susceptible host trees against goldspotted oak borer with insecticides at Oak Grove Campground, Palmoar RD, Cleveland NF.
Photo by: S. Hishinuma, USDA FS

south of Lake Henshaw, Cleveland National Forest. William Heise County Park had approximately 300 acres affected by GSOB; Dos Picos Regional Park had 31 coast live oaks (*Quercus agrifolia*) die; and Santa Ysabel Park had approximately 15 coast live oaks die.

In Orange County, GSOB remained localized in Weir Canyon. Ground surveys, removal of highly infested trees, and insecticides are being used to slow the spread of GSOB in coast live oak throughout the area (GSOB Quarterly Situation Report, Jan-March 2017). The Canyon II Fire burned through the GSOB infestation area in Weir Canyon from October 9-17, 2017. Follow-up studies on fire effects are being planned.

On the San Bernardino National Forest (Riverside County) GSOB has spread as far north as Black Mountain. It has been detected as far south as Keen Camp Summit (north of Lake Hemet). In the community of Idyllwild, San Bernardino National Forest personnel removed 2 GSOB-infested trees using the guidelines established by CALFIRE for tree removal on private land.

In Los Angeles County, tree inspections conducted by the Los Angeles Fire Department Forestry Division on private property around Green Valley resulted in 692 GSOB-infested tree detections; 204 have been removed (GSOB Quarterly Situation Report July-Sept. 2017). Also in the Green Valley area, in April 2017, a tree removal project was initiated by the Angeles National Forest to remove coast live oaks on national forest lands with moderate to severe GSOB infestations. Eighty-two trees were removed by fuels crews and new grinding equipment was tested for processing infested wood. The timely removal of these trees will likely decrease GSOB attacks on private and National Forest land in 2018.

Invasive Shot Hole Borers (*Euwallacea* spp.) and **Associated Fusarium Dieback** (*Fusarium* spp.)

Invasive shot hole borers (ISHB) are established throughout much of Southern California. In 2017, the Kuroshio shot hole borer (KSHB) was found in Los Angeles County for the first time. It is now present in 4 counties: Los Angeles, Orange, Santa Barbara, and San Diego. A larger trapping system around Santa Barbara resulted in the detection of several newly identified KSHB infestations in urban areas. In Santa Barbara County, Kuroshio shot hole borer (KSHB) continued to infest areas of Montecito, and in May 2017 KSHB was found in sycamore (*Platanus racemosa*) in Lotus Land. PSHB is established in Los Angeles, Orange, Riverside, San Bernardino and Ventura Counties, and at 1 location in San Diego County (San Elijo Lagoon) and continues to cause mortality in urban forests. In Ventura County, PSHB continued to spread along Highway 126 in riparian areas, from Interstate 101 to just south of Highway 23. PSHB is widespread along the base of the Angeles National Forest and has been found spreading north into Big Tujunga Canyon. In San Diego County, San Elijo Lagoon has 11 acres infested with PSHB. The main species affected include arroyo willows (*Salix lasiolepis*), cottonwood (*Populus fremontii*), and sycamore. Flinn Springs County Park was confirmed with KSHB on 8 sycamores and 1 coast live oak. The 8 sycamores were removed. In Guajome Regional Park, KSHB has infested a few sycamores.

No infestations have been found in San Luis Obispo County to date and no further finds, since the one KSHB in 2015, have been recovered from county traps. ISHB has not been detected on the Los Padres, San Bernardino, or Cleveland National Forests.

Twelve new ISHB/*Fusarium* disease complex reproductive hosts (support *Fusarium* sp. growth, which sustains beetle colonization) were identified in Southern California: king palm (*Archontophoenix cunninghamiana*), tamarisk (*Tamarix ramosissima*), red flowering gum (*Eucalyptus ficifolia*), American sweetgum (*Liquidambar styraciflua*), honey locust (*Gleditsia triacanthos*), Brazilian coral tree (*Erythrina falcata*), purple orchid tree (*Bauhinia variegata*), council tree (*Ficus altissima*), tulip wood (*Harpullia pendula*), Chinese flame tree (*Koelreuteria bipinnata*), laurel-leaf snailseed tree (*Cocculus laurifolius*), and southern magnolia (*Magnolia grandiflora*). None are native to California.

Individual balsam woolly adelgid from grand fir in Fortuna CA, Humboldt County. Photo by: C. Lee, CALFIRE

Black oak leaf miner causing blotches on oak foliage, Tahoe NF. Photo by: D. Cluck, USDA FS

Other Highlights

Balsam Woolly Adelgid (*Adelges piceae*)

Balsam woolly adelgid continued to cause grand fir (*Abies grandis*) mortality, branch gouting, and stand deterioration near Fort Bragg (Mendocino County). It was also found in the northern outskirts of Fortuna (Humboldt County) causing similar symptoms and mortality levels throughout ~20 acres of large grand fir, upslope of a residential neighborhood.

Black Oak Leaf Miner (*Eriocraniella aurosparsella*)

Blotch mining of black oak (*Quercus kelloggii*) foliage was observed in the Blue Canyon area of the Tahoe National Forest (Placer County) covering several hundred acres. This is the same area that experienced moderate to severe defoliation from 2006-2010. The amount of feeding was much lighter this year than during the previous infestations when most of the infested foliage was killed.

Galleries of California flatheaded borer in dead Jeffrey pine, Eagle Lake Resource Area, BLM. Photo by: D. Cluck, USDA FS

California Flatheaded Borer (*Phaenops californica*)

Nearly all Jeffrey pine mortality observed in northeastern California (<50 trees total) was caused by California flatheaded borer. Affected pines showed signs (pitch streaming on the bole and resin pockets under the bark) of being continuously attacked during the drought. These trees began to fade last fall and again in early spring as soon as temperatures started to warm. Attacked trees were generally located on the eastern edge of the Sierra Nevada and Cascade ranges on the driest sites. Highest levels of mortality (~40 trees total) were observed north of Susanville, within the Bureau of Land Management, Eagle Lake Resource Area (Lassen County). Older snags and downed logs in these same areas showed signs of wood borer attack from previous drought periods.

California flatheaded borer was more active in Jeffrey pines on the Inyo National Forest than Jeffrey pine beetle. Scattered mortality of Jeffrey pine was noted in and around Little Antelope Valley (Mono County) in patches of 1-5 acres. Ground surveys found wood borers heavily infesting trees on the bole and branches with red turpentine beetle attacks at the base. Crown fading was often irregular and variable. Infested sites were typically very xeric, south-facing slopes or had poor soil conditions as evidenced by stunted trees or poor structure.

California oakworm, San Luis Obispo County. Photo by: J. Gee, CALFIRE

Small Douglas-fir trees killed by flatheaded fir borer, Douglas-fir pole beetle, and a roundheaded boring beetle in a dense planted stand near Covelo, CA Mendocino County. Photo by: C. Lee, CALFIRE

California Oakworm (*Phryganidia californica*)
A severe California oakworm infestation affected approximately 50 acres in the Cambria area (San Luis Obispo County), with almost complete defoliation of coast live oaks. California oak worm has 2 generations per year, which can have devastating effects on already drought-stressed trees.

Flatheaded Fir Borer (*Phaenops drummondi*)
Douglas-fir mortality from attacks by flatheaded fir borer was evident along Highway 299 between Douglas City (Trinity County) and Whiskeytown Reservoir (Shasta County). In this ~30-mi stretch of road, numerous groups of Douglas-fir, many containing 12-15 dead mature trees, were mixed with individual dead Douglas-fir, primarily on south- and west-facing aspects.

Flatheaded fir borer, Douglas-fir pole beetle (*Pseudohylesinus nebulosus*), and an unidentified roundheaded boring beetle were killing small (7-12 in DBH) Douglas-fir trees on a private property near Covelo (Mendocino County). The stand, which covered nearly 1 acre, had been planted within the past 2 decades to replace mature Douglas-fir removed from the property. High stand density, together with an unusually high water table, were the suspected factors leading to the high levels of mortality (at least 50% of the trees, many just beginning to fade in September).

Ponderosa pine sawfly, El Dorado County. Photo by: R. Bellanca, RPF, Bella Wildfire & Forestry Services

Oak Twig Girdler (*Agrilus angelicus*)
Oak twig girdler was affecting numerous drought-weakened coast live oaks from Arroyo Grande to Santa Maria in San Luis Obispo and Santa Barbara Counties. High levels of damage occurred on the severely infested trees in Santa Maria. Normally long-term tree health is not compromised by infestations; however, due to the associated 5-year drought and trees still recovering, the overall health of these trees has been affected.

Ponderosa Pine Sawfly (*Neodiprion* sp.)
Ponderosa pine sawfly was recorded defoliating seedling and sapling-sized ponderosa pines at a site in El Dorado County. The exact species of sawfly was not determined. Similar injury was noted on scattered pine trees from this El Dorado County location north to the Oregon border.

Spruce Aphid (*Elatobium abietinum*)
Sitka spruce (*Picea stichensis*) stands along Highway 101 (Humboldt County), with consistently high levels of defoliation noted for decades (hosted extensive spruce spider mite infestations in 2016), were infested with spruce aphids in March. Defoliation along the highway between Eureka and Fortuna was more severe in 2017 in trees that were not noted to have severe defoliation in 2016, while many of the lower crowns of trees severely affected in 2016 appeared to have recovered in 2017.

Armillaria Root Disease (*Armillaria* sp.)
Three root-diseased California black oaks (*Quercus kelloggii*) were diagnosed with Armillaria root disease at the Dunsmuir Botanical Garden (Siskiyou County) in February 2017, following the failure of 2 of them, which destroyed a nearby stage. A sugar pine (*Pinus lambertiana*) 20 ft from the nearest infected oak also turned brown and died over the summer. Mycelial fans and rhizomorphs characteristic of the root disease were found on the roots and lower bole of the dead pine.

Bacterial Leaf Scorch (*Xylella fastidiosa*)
Bacterial leaf scorch continued to infect and kill numerous liquidambar (*Liquidambar styraciflua*) trees throughout urban areas of Los Angeles, Riverside, and San Bernardino Counties. Many of the infested trees have been removed, causing liquidambar to become much less common in these urban landscapes. Where they have been removed, the trees have been replaced by other less susceptible species.

Black Stain Root Disease (*Leptographium wageneri*)
A black stain root disease mortality center with 8 dead ponderosa pines (*Pinus ponderosa*) was found in the southern part of the Prattville Forest Restoration Area (PFRA, Plumas County), 1 mi west of Prattville near Lake Almanor. The presence of bark beetle pitch tubes suggests that bark beetles killed the trees which were stressed by the root disease. The PFRA is a 1,200-acre ponderosa pine plantation planted in the 1960s in a bulldozed brush field that resulted from a fire earlier in the 20th century. In 1993 and 2002, all identified black stain root disease centers were cleared, and the surrounding trees were thinned in an effort to control the disease. The current infected location was not previously treated. Ponderosa pine is very susceptible to black stain root disease, contributing to disease persistence in the PFRA.

In Southern California, black stain root disease continued to affect single-leaf pinyon pine (*Pinus monophylla*) trees in the Big Bear Lake area of the San Bernardino Mountains (San Bernardino County). Continued mortality is also likely related to the recent 5-year drought.

In 2006, approximately a dozen bristlecone pines (*Pinus longaeva*) in the Methuselah Grove of the Ancient Bristlecone Pine Forest, Inyo National Forest (Inyo County), were analyzed to see if black stain root disease was killing them. Trees that were considered diseased and dying in 2006 were still alive in 2017, but with vastly reduced crowns. Over the last 3 years, black stain root disease has been recovered from 4 trees suspected of being infected.

Trees infected with black stain root disease in the Prattville Forest Restoration Area. Photo by: W. Woodruff, USDA FS

Black oak failures caused by Armillaria root disease at Dunsmuir Botanical Garden.
Photo by: P. Angwin, USDA FS

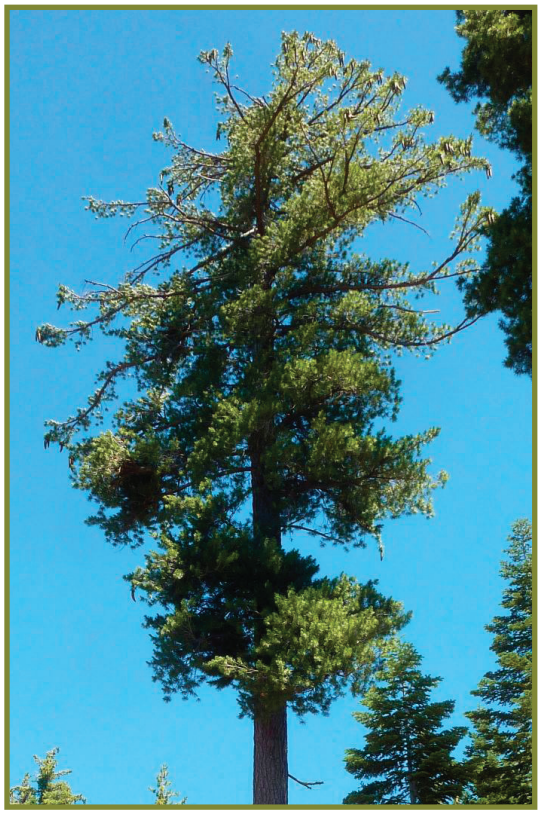
Black stain in the xylem of a dead ponderosa pine tree.
Photo by: W. Woodruff, USDA FS

Boxwood blight, caused by *Calonectria pseudonaviculata*, in San Mateo County.
Photo by: K. Kosta, CDFA

Examples of boxwood branches with boxwood blight.
Photo by: K. Kosta, CDFA

Boxwood Blight (*Calonectria pseudonaviculata*)
Boxwood blight was first detected in California in San Mateo (San Mateo County) residential boxwood (*Buxus* spp.) plantings in December 2016. Samples taken from 9-year-old established boxwood (*Buxus sempervirens* 'Suffruticosa') plantings were found positive for *C. pseudonaviculata*. Trees at two other residential sites were also found positive. This disease has not been found in California nurseries, but is known to occur in Oregon nurseries and is found throughout Europe. Pachysandra (*Pachysandra* spp.) and sweet box (*Sarcococca* spp.) are also hosts of boxwood blight. In October 2011 boxwood blight was found in North Carolina and Connecticut. By January 2012 it had also been identified in Virginia, Maryland, Rhode Island, Massachusetts, Ohio, Oregon, Pennsylvania, New York, and British Columbia. Early symptoms can appear as darkened, somewhat purplish discoloration of the foliage in patches or individual leaves along with tan to dark brown, circular leaf spots. Narrow longitudinal black lesions are present on the stems. Advanced symptoms are overall browning and defoliation. The potential host range in California is unknown.

Dwarf Mistletoe (*Arceuthobium californicum*) **on Sugar Pine**
A heavy infestation of sugar pine dwarf mistletoe was detected along 1 mi of Forest Service Road 27N38 on approximately 80 acres in Plumas County, 1.25 mi south of the town of Canyon Dam. Large brooms were found in the lower crowns of approximately 1/3 of the mature sugar pine, and most lower branches in approximately 1/2 of the understory sugar pines were infected.



Sugar pine with dwarf mistletoe brooms in the lower crown.
Photo by: W. Woodruff, USDA FS

Fir Heart Rot (*Pholiota adiposa*)
Pholiota adiposa was observed fruiting on dead white fir (*Abies concolor*) snags in a ponderosa pine/white fir stand near Beardsley Road on the Stanislaus National Forest in 2016 and 2017. The fungus was fruiting sporadically throughout the 20 acres surveyed. *P. adiposa* is a fall fruiting species and is only detectable a few weeks in October. In the West, *P. adiposa* and *P. limonella* cause a significant amount of true fir heart rot, yet the extent of this damage is largely under recorded because these fungi have such a narrow fruiting window.

***Fusarium avenaceum* on Jeffrey Pine**
Fusarium avenaceum was isolated in 2016 from the dying terminal shoots of 3 (10-15 ft tall) planted Jeffrey pines (*Pinus jeffreyi*) on a private tree farm off of Burr Valley Road, near where Highway 36 crosses the Humboldt/Trinity County border. In 2017, the pathogen killed terminals of approximately 100 more planted Jeffrey pines on the plantation. Similar-sized planted ponderosa pines

Sugar pine dwarf mistletoe plants with seed-bearing fruit.
Photo by: W. Woodruff, USDA FS

on the same property were unaffected. Other *Fusarium* spp. (all closely related to *F. avenaceum*) were isolated from branches and tips exhibiting dieback, as well as leaf spots, on several other tree species, including California bay laurel (*Umbellularia californica*) in Humboldt and Santa Clara Counties and Douglas-fir (*Pseudotsuga menziesii*) in Humboldt County.

***Ganoderma* Wood Decay** (*Ganoderma adspersum*)

During surveys of almond (*Prunus dulcis*) trees for wood decay fungi in 2016, a 120-acre orchard of 9- and 10-year-old almond trees in Kings County was found to be experiencing almost 20% of trees failing over a 3-year period. The orchard was removed at the end of 2016. Molecular identification of isolates (in 2017) from the orchard recovered *Ganoderma adspersum*, a species not previously reported in North America. *G. adspersum* was shown to be more aggressive than other Ganoderma species, causing extensive decay that is not limited to the heartwood, as is usually the case with other *Ganoderma* species. A 12-year-old orchard in Fresno County was also identified in 2017 with a high incidence of *G. adspersum* and is being surveyed. A large proportion of the trees in the orchard have fungal fruiting bodies, some of which appear to be at least several years old, suggesting a much earlier infection. Trees in urban or forest settings could be susceptible as the potential host range of this fungus in California is unknown at this time.

Ganoderma adspersum conks. Photos by: B. Johnson, UC Davis

***Phytophthora* Root Diseases** (*Phytophthora* spp.)

Phytophthora cactorum was baited from soil under declining and dying tanoaks (*Notholithocarpus densiflorus*) and madrones (*Arbutus menziesii*) along the City View Trail in Ukiah (Mendocino County). The declining trees covered approximately 5 acres. Most trees had bleeding cankers on the trunk (at 1-6 ft); however, no pathogen has been isolated from the cankers. An almost identical decline of tanoaks and madrones has been observed over several years on Mount Madonna on private property (Santa Cruz/Santa Clara County boundary), where tree die-off is scattered and in clumps and covers at least 40 acres. As with the trees in Ukiah, attempted isolations from bleeding cankers have been unsuccessful. A similar *Phytophthora* sp. was baited from area soil. Polymerase chain reaction and sequencing of the internal transcribed spaces region narrowed the isolated oomycete down to either *P. cactorum* or the closely related *P. pseudotsugae*; collection of additional material and sequencing of other genomic regions will be required for a definitive identification.

Tanoak and madrone mortality associated with soils infested with *Phytophthora cactorum* or *Phytophthora pseudotsugae* on Mount Madonna (Santa Cruz/Santa Clara County). Photo by: C. Lee, CALFIRE

Other *Phytophthora* or closely related species were isolated from sites with widespread bishop pine (*Pinus muricata*) decline in Mendocino and Sonoma Counties. *P. cinnamomi* was baited from soil in mature bishop pine stands at Salt Point State Park (Sonoma County) in areas where trees exhibited thinning crowns and black, rotten medium-size (2-5 mm diameter) feeder roots. Isolations from rotting roots did not yield the pathogen. Trees also showed symptoms of pitch canker (*Fusarium circinatum*), western gall rust (*Endocronartium harknessii*), velvet-top fungus (*Phaeolus schweinitzii*), and *Elongisporangium undulatum* (also known as *Pythium undulatum* or *P. undulata*), a proven pathogen of conifers in Europe, was baited from soil. *E. undulatum* was also baited from pygmy forest soils under declining bishop pines near Mendocino, where trees over at least a 60-acre area were showing decline from multiple agents, including western gall rust and dwarf mistletoe (*Arceuthobium littorum*).

Phytophthora species closely related to *P. citrophthora* or *P. colocasiae* were detected from soil in Santa Clara County beneath a lawn near a dying elm (*Ulmus*) tree as well as from a Humboldt County roadside location where byproducts of highway construction work are commonly stockpiled. At the Humboldt County site, repeated soil sampling also detected *P. cambivora*, *P. gonapodyides*, and *E. undulatum*, and dying Port-Orford-cedars have been confirmed infected with *P. lateralis*.

Phytophthora cinnamomi led to dieback and mortality centers of white fir at locations in Kyburz (El Dorado County) and Avery (Calaveras County). Each site lost about 12 trees and had experienced flooding during the extremely wet 2016/17 winter.

Phytophthora root diseases continued to be an issue for native plant nurseries and restoration projects on forests in Southern California. The Angeles and San Bernardino National Forests (Los Angeles and San Bernardino Counties) worked to prevent introductions in native restoration sites. The San Bernardino National Forest implemented best management practices in their nursery operations to prevent disease establishment and tested nursery stock to be sure it was disease free prior to outplanting.

Pitch Canker (*Fusarium circinatum*)
The pitch canker pathogen was recovered from roadside shore (*Pinus contorta*) and bishop pine branch samples taken along Highway 1, 10 mi north of the Sonoma/Mendocino County border (northernmost known infestation). Pitch canker was also observed in Salt Point State Park (Sonoma County) causing pervasive and severe branch dieback in both young and mature bishop pine stands along the approximate 3-mi length of Highway 1 in the park.

Port-Orford-Cedar Root Disease (*Phytophthora lateralis*)
Port-Orford-cedar root disease caused increased levels of mortality in Del Norte and Humboldt Counties. The disease killed 2-4 mature ornamental Port-Orford-cedar (*Chamaecyparis lawsoniana*) trees on private property in McKinleyville (on the western edge, first ridge north of the Mad River, Humboldt County). Within the well-established infestation along Highway 299 between Berry Summit and Willow Creek, 4-5 scattered new dead trees were visible. Mortality of Port-Orford-cedar of all sizes continued on a 7-acre site near the Little Bald Hills Trail at Redwood National Park (Del Norte County). An operational planting trial of resistant Port-Orford-cedar was established on the site in 2016 and is being monitored.

A total of 40 Port-Orford-cedar died at the 4 Port-Orford-cedar root disease test sites on the Six Rivers National Forest (Humboldt and Del Norte Counties), compared to 10 in 2014, 19 in 2015, and 9 in 2016. Genetic tests at Oregon State University will determine how many of the 40 cedars died from *P. lateralis*. Very few (only 1 or 2 per year) had the pathogen the previous 3 years.

A Port-Orford-cedar root disease infestation discovered in 2016 at the intersection of Forest Service Road 10N12 and Red Mountain Creek, approximately 2 mi from the entrance to Fish Lake Campground (Six Rivers National Forest, Humboldt County), tripled in size from 2016 to 2017, now totaling approximately 3 acres. Management actions in the area have included instituting wet-period seasonal road closures along the Bluff Creek Road, removing all Port-Orford-cedar in Fish Lake Campground, improving road surfaces to reduce water pooling and improve drainage, installing fences

Advancing cambial necrosis caused by *Phytophthora lateralis* in a dying Port-Orford-cedar tree in Del Norte County.
Photo by: C. Lee, CALFIRE

Dead Port-Orford-cedar at Fish Lake resistance test site, Six Rivers National Forest. Photo by: P. Angwin, USDA FS

Dead Port-Orford-cedar at the intersection of Forest Service Road 10N12 and Red Mountain Creek, Six Rivers National Forest. Photo by: P. Angwin, USDA FS

Infected Port-Orford-cedars with characteristic stain near the Little Bald Hills trail at Redwood National Park, Humboldt County. Photo by: P. Angwin, USDA FS

to separate cars and people from Port-Orford-cedar, installing a paved boat ramp at Fish Lake, and information signs to educate visitors about the problem and what they can do to help. All of these actions have been aimed at reducing the transport of the pathogen from infested areas and protecting uninfested areas. Resistant Port-Orford-cedar has also been planted in the area to test resistance in the field.

Visual surveys in 2017 revealed no new Port-Orford-cedar infections near the *P. lateralis* eradication treatment site at Scott Camp Creek on the Shasta-Trinity National Forest (Siskiyou County). First detected in 2001 and treated in 2004-2005, the pathogen has not been detected in or around the eradication zone since 2008.

Sudden Oak Death (*Phytophthora ramorum*)

Prolonged and widespread rain throughout most of California over the 2016-2017 winter followed a 2015-2016 winter with generally average to slightly above average precipitation. These 2 wet winters contributed to moderate increases in sudden oak death bole infections in tanoak and coast live oak (*Quercus agrifolia*) as well as significant increases in foliar and twig detections in California bay laurel and various manzanita (*Arctostaphylus* spp.) species (see below). Based on 2017 observations and lag times of 2-3 years between inoculum buildup and landscape-scale mortality of oak and tanoak, greater increases in *P. ramorum*-caused mortality may be observed in 2018.

<u>Bay Area and Southern Quarantine Counties</u>

San Luis Obispo County spring surveys (289 trees sampled) did not recover *Phytophthora ramorum*, leading to the determination that 2016 “detections” were false positives and the county remains uninfested. The pathogen was detected for the first time in San Carpoforo Creek along the San Luis Obispo/Monterey County border. It is undetermined which county contains the vegetation source for this waterborne inoculum.

SOD Blitz spring surveys conducted by citizen scientists in coastal counties involved over 600 people in 23 communities sampling 2,000 trees. For the first time, multiple areas were *P. ramorum*-positive in the San Francisco Presidio (San Francisco County) on camellia (*Camellia* sp.), coffeeberry (*Frangula californica*), toyon (*Heteromeles arbutifolia*), and bay. On the UC Berkeley campus (Alameda County), natural areas and the UC Botanical Garden were found to be infested. The pathogen was also detected in the UC Santa Cruz Arboretum (Santa Cruz County), with several rare plant species found positive (Koch’s postulates evaluations are underway).

Diablo Foothills Regional Park (East Bay Regional Parks, Contra Costa County) had the highest percentage of infection in stands with relatively low bay density. Approximately 33% of the coast live oaks (*Q. agrifolia*) in plots were symptomatic for *P. ramorum*, and 6% were dead with late-stage sudden oak death symptoms. Symptomatic California black oaks were also present. These relatively high infection levels developed despite blue oak (*Q. douglasii*) being the dominant oak species (not a known *P. ramorum* host) with less abundance of California bay laurel, and a hotter, drier climate than in other East Bay Regional Parks.

Previously known infested areas continued to record outbreaks in southern Mendocino County, Point Reyes National Park near Point Reyes Station (Marin County), and in western San Mateo County. Farther south, the pathogen was recovered in the Carmel Valley (Monterey County).

Northern Quarantine Counties

There was a moderate increase in oak and tanoak mortality throughout most of the North Coast region. Sonoma County *P. ramorum* infection levels increased, with the pathogen found to have re-emerged near Cloverdale, and it was recovered at very high levels east of Healdsburg, around Santa Rosa and Glen Ellen. *P. ramorum* was also prevalent in rural and forested areas west and east of Petaluma. As in 2016, one of the most widely affected areas was the northwest Sonoma County coast, between Cazadero Road/Fort Ross Road and Highway 1, where both individuals and groups of tanoaks died during the summer. New sudden oak death symptoms were observed on coast live oaks (*P. ramorum* was confirmed on bay) along the upper reaches of Sonoma Creek in Sugarloaf Ridge State Park, and dying tanoaks near heavily infested bays were observed along a 1-mi stretch of Vigilante Road near Glen Ellen.

A dry spring and summer led to flashy fuels buildup and rapid fuel moisture dry-downs that contributed to large wildfires, of which the extremely damaging Sonoma/Napa County fires were the most prominent. Many of these wildfires burned in areas infested with *P. ramorum* (e.g., the Sugarloaf Ridge and Glen Ellen areas noted above, as well as the 2016 Soberanes Fire in Big Sur). Previous observations have documented that wildfires may reduce, but not eliminate, *P. ramorum* inoculum from infested sites.

Tanoak top-killed by 2016 Soberanes Fire. The tanoak resprouted after top-killing, and the sprouts on the right were subsequently infected by *P. ramorum*.
Photo by: K. Frangioso, UC Davis

In Humboldt County, scattered, newly dead tanoaks could be seen along the South Fork Eel River, south of Benbow. West of the river along Thomas Road, an approximate 800-acre polygon of tanoak mortality (1-5 trees per acre) continued to fill in with new dead tanoaks, and scattered new mortality was visible along Salmon Creek Road, between Thomas Road and Highway 101. Tanoaks (averaging 1-2 per acre) continued to die along the Dyerville Loop Road on the top of the ridge separating the South Fork and Main Stem Eel River, and scattered 100-500-acre polygons with similar levels of mortality were identified by aerial observers in the Larabee Creek drainage stretching northeast from Bridgeville.

In northern Humboldt County, *P. ramorum* was confirmed 3 mi from currently uninfested Hoopa Valley tribal lands. Tanoak and bay trees were found positive for the pathogen on Bureau of Land Management lands along Lacks Creek (a tributary of the Redwood Creek watershed near King's Crossing), adjacent to the Redwood Valley infestation (found positive in 2011). This was the first confirmed positive terrestrial find in the watershed and may be responsible for a 2016 stream positive at Lacks Creek near King's Crossing (downstream of the infestation). Ground surveys and Google Earth imagery were used to monitor for *P. ramorum* symptoms along a tributary of Lacks Creek at Flyette Prairie (Bureau of Land Management lands), and symptomatic bay and tanoak vegetation samples were collected. *P. ramorum* was cultured initially from a tanoak twig and subsequently on both tanoak twigs and bay leaves. Symptomatic vegetation was sparse.

Eubank Creek, a tributary of the Mattole River, and Yager Creek, a tributary of the Van Duzen River near the town of Carlotta along Highway 36 (Humboldt County), were found *P. ramorum*-positive. The sources of the Eubank and Yager Creek infestations are not known. Symptomatic bay samples were collected above and below the Eubank Creek stream monitoring site; all samples were negative. Google Earth imagery searches were conducted along Yager Creek and Lawrence Creek (flows into Yager), as most properties adjacent the creek are private lands. No tree mortality was visible. Potential ground sources could include a previously confirmed *P. ramorum* infestation farther upstream on a privately owned ranch.

Redwood National and State Parks (Humboldt County) have discontinued their slow-the-spread efforts in response to continued pathogen outbreaks beyond treated areas and models indicating buffer zones would need to be greatly increased to achieve significant pathogen reduction. The parks plan to implement a monitoring and research program that will be complemented with strategic management actions if the pathogen threatens highly valued oak/tanoak individual trees or stands within park boundaries.

North Coast field surveyors had difficulty culturing *P. ramorum* from symptomatic bay leaf samples starting in April. Impacts from the recent 5-year drought may be the cause of bay not yielding the pathogen, though drought conditions were not as severe in the North Coast as in other areas of the state. In recent years, seasonality accounted for bays typically not yielding the pathogen in late summer/early fall. Conversely, symptomatic tanoak twig samples continued to yield the pathogen and produced chlamydospores.

New Hosts

Multiple species of manzanita were reported infected with *P. ramorum* from nurseries, arboreta, and natural areas in several Bay Area counties. Bigberry manzanita (*Arctostaphylos glauca*) was found positive on landscape plants in a native plant nursery, and pallid manzanita (*A. pallida*) was confirmed in the Tilden Park area (Contra Costa County). Other *P. ramorum* first detections on *Arctostaphylos* species include Monterey (*A. montereyensis*), silverleaf (*A. silvicola*), and Montara manzanita (*A. montaraensis*). California is the world's center of diversity for this genus.

Nurseries

California had 17 *P. ramorum*-positive nurseries identified through October 2017. Two of the positive nurseries were found during inspections conducted under the bi-annual sampling portion of the federal *P. ramorum* regulatory program. Twelve facilities are retail nurseries that do not ship out of the quarantined area and are therefore not required to implement the Confirmed Nursery Protocol. In all, 122 *P. ramorum*-positive plants were identified by the California Department of Food and Agriculture, including camphor (*Cinnamomum camphora*), bigberry manzanita, bay, and sweet bay (*Laurus nobilis*) as well as *Camellia* and *Rhododendron* species.

Tubakia Dieback (*Tubakia* sp.)

Scattered tanoak trees in several Humboldt and Del Norte County locations (especially along Highways 101, 299, and 96) exhibited defoliation and branch dieback from a *Tubakia* sp. (still under formal description by California Department of Food and Agriculture). Several tanoaks just west of Willow Creek along Highway 299 that exhibited severe defoliation by this pathogen in 2016 appeared dead in 2017.

Velvet Top Fungus Root Disease (*Phaeolus schweinitzii*)

Velvet-top fungus continued to be the most recovered root pathogen in northern coastal counties, especially on large, old-growth Douglas-fir and Sitka spruce (*Picea sitchensis*). The fungus was also found on declining bishop pine in Humboldt, Mendocino, and Sonoma Counties.

Western Gall Rust (*Endocronartium harknessii*)

Western gall rust was observed causing extensive branch and tip dieback in bishop pines in Humboldt and Mendocino Counties. Observed injury was especially severe near the town of Mendocino and in Russian Gulch State Park (Mendocino County), where it affected large stands of trees dozens of acres in size, and near Humboldt State University (Humboldt County), where it affected small groupings of 3-5 roadside trees in several locations. The pathogen was observed sporulating in May and then again in September in Mendocino County. It is possible that the extended sporulation season was responsible for disease severity in coastal locations and that excessive precipitation over the 2016-2017 winter contributed to the elevated levels of injury at these sites.

White Pine Blister Rust (*Cronartium ribicola*)

An extensive survey for white pine blister rust infecting sugar pine and western white pine (*P. monticola*) was conducted along roads in northeastern California. Almost no flagging was observed in mature pines and only occasional dead or infected understory seedlings or saplings were found. Approximately 65 mi of road were surveyed through white pine forests in Shasta, Lassen, Plumas, and Sierra Counties. In addition, approximately 30 acres were surveyed intensively. On Ashpan Butte, 1 mi northwest of Ashpan Snow Park on Highway 44 (Shasta County), 2 young sugar pines had blister rust bole cankers 4 ft above ground. Hundreds of mature and young sugar pines were examined over the 8-acre butte, however no other active blister rust was found.

Top of sugar pine killed by white pine blister rust.
Photo by: W. Woodruff, USDA FS

Seven miles southwest of Ashpan Snow Park (Lassen County) saw-timber-sized sugar pines on the Cabin Plantation were examined for blister rust. This 1960s plantation is in a converted brush field planted to an 8x8 ft spacing with an estimated 95% ponderosa pine and 5% sugar pine, in addition to a few giant sequoias (*Sequoiadendron giganteum*). Based on rough calculations, 90% of the sugar pine died from blister rust as seedlings and saplings. An estimated 60% of the surviving 50-year-old sugar pine on the plantation are free of blister rust and 40% have lower bole cankers caused by infections that occurred soon after planting. Efforts are underway to collect seed from the surviving sugar pine to test for slow rust and major gene resistance to the pathogen.

White pine blister rust bole canker and aecia on a 6' sugar pine sapling. Photo by: W. Woodruff, USDA FS

White pine blister rust canker and aecia on a western white pine sapling near Yuba Pass. Note the tiny aecia just left of the center of the tree. Photo by: W. Woodruff, USDA FS

In a 5-acre mixed conifer stand 0.8 mi southwest of Prattville on Lake Almanor along the road to Butt Valley Reservoir (Plumas County), very little blister rust flagging and 1 dead top were observed on sugar pine; however, blister rust cankers and aecia were found girdling a 6 ft tall sugar pine sapling and a branch on a 1 in diameter sapling.

Approximately 10% of all western white pine in a 5-acre mixed-conifer stand 1 mi south of Yuba Pass Campground on Highway 49 (Sierra County) were infected with white pine blister rust. Cankers with aecia were found on the lower boles of 2 western white pine seedlings. Bole cankers without aecia were found on understory trees of all sizes, and at least 1 top-killed overstory western white pine was confirmed to have blister rust.

White pine blister rust was not found on whitebark pine (*Pinus albicaulis*) during follow-up surveys on Sonora Pass (Tuolumne, Alpine, and Mono Counties), even though the disease had been found there previously. However, white pine blister rust was found sporulating profusely on *Ribes* spp. (the alternate hosts) in the area. Similar observations on *Ribes* were noted in various locations in the central Sierra Nevada region.

Drought

Effects from the 5-year drought continued to impact trees throughout the southern and central Sierra Nevada range, despite high levels of rainfall in 2016-2017. Extreme drought-related stress, along with the loss of fine feeder roots and portions of canopies, left many trees vulnerable to insects as well as direct drought-related mortality. Oaks (*Quercus* spp.) and incense cedar (*Calocedrus decurrens*) throughout the Sierra Nevada foothills were particularly impacted.

High levels of coast live oak (*Quercus agrifolia*) mortality occurred in localized areas of Talega Canyon (Orange County) and the Camp Pendleton hotel training area (San Diego County). Drought combined with oak ambrosia beetle (*Monarthrum* spp.) are thought to be the cause of this dieback, with 133 trees having died in Talega Canyon and 101 in the hotel training area.

Torrey pine (*Pinus torreyana*) and blue gum eucalyptus (*Eucalyptus globulus*) mortality occurred in North Tustin/Cowan Heights (Orange County). Drought is the suspected cause.

Trees in Southern California urban areas continued to show drought stress, especially in locations where watering regimes had been changed due to drought restrictions and low summer rainfall. Declines were seen in planted species such as ash (*Fraxinus* spp.), eucalyptus (*Eucalyptus* spp.), deodar cedar (*Cedrus deodara*), crape myrtle (*Lagerstroemia* spp.), sycamore (*Platanus americana*), birch (*Betula* spp.), and flowering pear (*Pyrus calleryana*).

Single-leaf pinyon (*Pinus monophyla*), ponderosa (*Pinus ponderosa*), Jeffrey (*Pinus jeffreyi*), and sugar pine (*Pinus lambertiana*) in the Big Bear Basin and many eastern areas of the San Bernardino Mountains appeared less stressed than in recent years. However, ponderosa, Jeffrey, and sugar pine in the Barton Flats area of the San Bernardino Mountains (San Bernardino County) still showed signs of drought stress. Approximately 50 white fir (*Abies concolor*) trees over 20 acres in Angeles Oaks (Los Angeles County) died due to drought.

Drought stress, woodborers, and occasionally *Phloeosinus* bark beetle species contributed to incense cedar decline and mortality in southern Sierra forests. Beetle gallery density was low and often only widely scattered on the bole, leading to the conclusion that mortality was driven more by drought stress than by insects. *Phloeosinus* species were only noted in very small diameter stems or green stems that were blown down. Dry site conditions (lower elevations, intermix of oaks) or high tree density was also noted on sites with elevated levels of cedar mortality. These same sites coincided with areas of high levels of ponderosa pine mortality on the Sierra and Sequoia National Forests. On the Stanislaus National Forest (Calaveras, Tuolumne, and Mariposa Counties), group mortality was noted on lava caps and dry ridge tops in smaller diameter stems.

Scattered mortality of mature white alder (*Alnus rhombifolia*) and willow species (*Salix* spp.) was observed in riparian areas on the Angeles (along Mt Baldy Road), San Bernardino (Front Country Ranger District), and Cleveland (along Silverado Canyon Road) National Forests (San Bernardino, Riverside, and San Diego Counties). In all 3 areas, less than 100 trees were dead. Secondary insects were also observed, but drought was likely the primary cause of tree death.

Group of giant sequoias that were affected by the Rough Fire (2015), Little Boulder Creek Grove, Sequoia NF. Photo by: B. Bulaon, USDA FS

Early Oak Leaf Fall

Extreme 100º F temperatures during late summer caused central valley oaks to drop leaves prematurely. Homeowners and landowners in the foothill areas surrounding the central valley were concerned their trees had died; however, close examination revealed they still had living cambium and healthy buds. The most impacted oak species were California black oak (*Quercus kelloggii*) and blue oak (*Q. douglasii*).

Giant Sequoia Health in Sequoia National Forest

An extensive survey of giant sequoia (*Sequoiadendron giganteum*) groves was conducted on the Western Divide Ranger District, Sequoia National Forest (Tulare and Kern Counties) during the summer to assess tree health following the 5-year drought. Groves in the Golden Trout Wilderness (Upper Tule, Middle Tule, Silver Creek, and Maggie Mountain) and Giant Sequoia National Monument (Alder Creek, Belknap Complex, Black Mountain, Burro Creek, Cunningham, Deer, Freeman, Long Meadow, Mountain Home, Packsaddle, Peyrone, Red Hill, Starvation Creek, and

Wishon) were surveyed. No recent mortality was identified, but several trees had large upper-canopy branches broken that were heavily attacked by cedar bark beetles (*Phloeosinus* sp.). Foliage retention and coloration of most trees was full and green, while a few had some yellowing that appeared to be normal needle slough.

Four giant sequoias (91-121 in DBH) recently died in the Little Boulder Creek Grove (Hume Lake Ranger District, Sequoia National Forest, Fresno County). Trees were first detected by aerial survey, then ground checked. Mortality was likely a result of low water tables in the meadow combined with basal girdling via fire injury from the 2015 Rough Fire. Burn scars showed undercutting at the root flare, wood exposure due to loss of bark, and depth of burning. No insect activity was noted at tree bases, but some fallen limbs were infested by bark beetles.

Burn scar on a giant sequoia that was affected by the Rough Fire (2015), Little Boulder Creek Grove, Sequoia NF. Photo by: B. Bulaon, USDA FS.

Black Bear (*Ursus americanus*)
Widespread tree death caused by black bears continued throughout Humboldt County and in northern Mendocino County. On private property near the Ten Mile River (Mendocino County), bears caused 50% mortality of planted redwood trees (*Sequoia sempervirens*) over 20-30 acres. In northern Humboldt County, black bears caused scattered mortality (2-3 trees/acre) over thousands of acres of industrial timberland.

Porcupine (*Erethizon dorsatum*)
One 10 in diameter sugar pine (*Pinus lambertiana*) on Horse Mountain (Humboldt County) was girdled by a gnawing animal, most likely porcupine based on tooth mark size.

Squirrels (*Sciurus griseus*)
Scattered flagging caused by squirrels girdling branches was observed on many big leaf maple trees (*Acer macrophyllum*) as well as occasional squirrel-caused top kill on small redwood trees along Highways 299 and 101 in Humboldt County.

Girdling damage to sugar pine presumably caused by a porcupine on Horse Mountain (Humboldt County). Photo by: C. Lee, CALFIRE

New Biocontrols for California

Giant Reed or Arundo (*Arundo donax*)

The arundo wasp (*Tetramesa romana*).
Photo by: J. Goolsby, USDA ARS

Arundo is a riparian weed thought to be native to eastern Asia that can dominate streambanks, creating dense, impenetrable bamboo-like thickets that shade out native riparian vegetation and consume inordinate amounts of water. It spreads mainly through vegetative reproduction, and flood events can move rhizomes and plant parts down stream where new populations can become established. Highly susceptible to burning throughout the year, arundo also represents an increased fire hazard in riparian areas. Two biocontrol agents have recently been introduced into California in an effort to manage arundo - the arundo wasp (*Tetramesa romana*) and the arundo armored scale (*Rhizaspidiotus donacis*). The arundo wasp deposits its eggs into the main and lateral shoot tips of arundo, where the eggs and developing larvae induce gall formation. Over time, galling by the wasp reduces live biomass by killing side stems and young main stems. The arundo wasp is broadly established in southern California, but damage levels are not as high as expected compared to studies from the Lower Rio Grande Basin of Texas (Goolsby et al 2016; Moran et al 2017) where the insect has also become established. Release occurred in northern California beginning in 2010 at a few sites and continued at nine sites in 2017, but the wasp is not yet established there. The arundo armored scale attacks developing underground buds of arundo on the rhizome near the soil surface and also at the base of lateral shoots, resulting in gradual thinning of infested arundo stands over time. The arundo scale was first released in California in 2015 and was confirmed as established at several sites in northern California by 2017. Releases continue to increase armored scale establishment throughout areas of California.

Cape ivy (*Delairea odorata*)


Cape ivy (*Delairea odorata*) smothering native vegetation on the Brazil Ranch, Los Padres NF). Photo by: D. Bakke, USDA FS

Cape ivy is an invasive, smothering vine native to South Africa that is difficult to control once established. It can cover small trees and large areas of ground and is most damaging in coastal riparian habitats. Introduced to California to help control Cape ivy, the shoot tip-galling fly (*Parafreutreta regalis*) lays its eggs inside the plant's growing shoot tips. The plant forms galls in response to the egg deposition and larvae feeding, and the larvae mature in the gall. Experimental results from the lab prior to field release showed a 50% reduction in biomass and size of Cape ivy plants. As reported in the 2016 California Forest Pest Conditions Report, this stem galling fly was first permitted in California in May 2016 and released (initially in cages) in September 2016 in several locations in the Bay Area, including the East Bay Hills. In 2017 it was re-released at the 2016 sites as well as 10 additional sites located in Humboldt, Sonoma, Alameda, San Francisco, San Mateo, Monterey, San Luis Obispo, and to Santa Barbara Counties. Over 100 galls (approximately 13 per site) were found after cage removal. Seasonal drought-related dieback of Cape ivy appeared to limit gall formation in southern California. Confirmation of establishment will be assessed in 2018 after an overwintering period. Additional releases are planned for southern California in 2018. Researchers are determining the importance of factors such as plant geographic location and mechanical stress (wind) on initial fly establishment. Fly impacts on Cape ivy growth and the ability of Cape ivy to exclude other plant species are expected to emerge over the next few years.

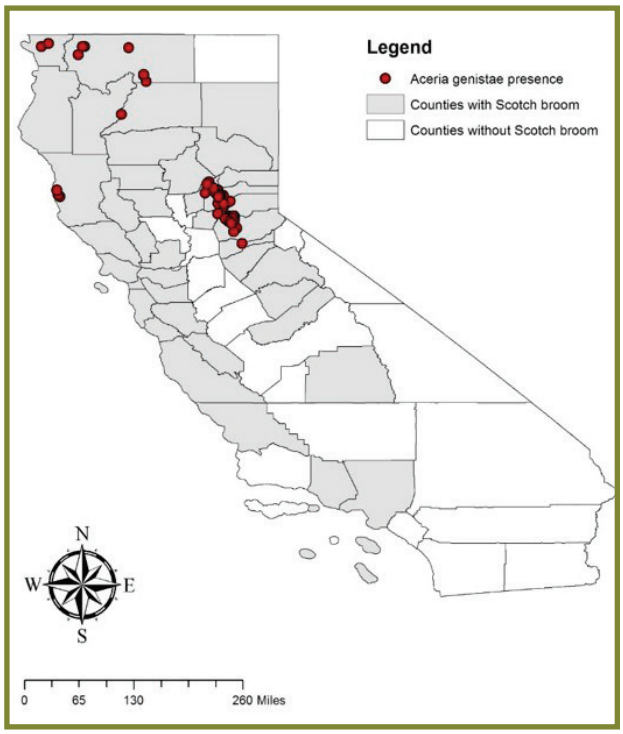

Galls on Cape ivy caused by Cape ivy fly. Note the 'windows' on the galls. Photo by: S. Portman, USDA ARS

Scotch broom (*Cytisus scoparius*)

Scotch broom is a perennial shrub that can develop dense thickets, displace native plants, and increase fire risk. It is commonly found in the Pacific coastal region of North America from British Columbia through California. The seed bank is very long lived. Although never approved for release in the US, the European Scotch broom gall mite (*Aceria genistae*) has become established

in California and causes the formation of numerous galls on Scotch broom plants. Plants with high gall densities suffer from stem dieback. As reported in the 2016 California Forest Pest Conditions Report, a 2017 study was planned to determine if this gall mite represents a risk to native California species so that a formal process to approve this biocontrol for further movement and release could be completed. Initial study results indicate that the mite appears to be host specific to Scotch broom (it is not attracted to other broom species nor native lupine species), although more testing is needed to verify this preliminary finding. Results (still to be verified) also indicated that gall formation on Scotch broom caused a decrease in seed production. More intensive surveys in 2017 determined that the gall mite is located in 11 California counties, with the majority of detections found in the central and northern Sierra Nevada range, from Lassen County south to Amador County. Climate modeling, also completed in 2017, indicated that this gall mite has the potential to expand throughout much of the currently infested Scotch broom area.

Galls on Scotch broom caused by Scotch broom gall mite (*Aceria genistae*). Photo by: P. Pratt, USDA ARS



Distribution of *Aceria genistae* in California.
Map by: P. Pratt, USDA ARS

Reaction to October North Bay Wildfires

Twenty-nine percent of the Sonoma Creek watershed burned in the October wildfires. In late 2017, the Sonoma Ecology Center began working with other nonprofits to develop a coordinated response to the Sonoma County fires, including producing a set of Best Management Practices to help residents avoid environmental degradation to the watershed, including invasive plant spread. Sonoma Valley fire recovery information is available online at https://www.sonomaecologycenter.org/fire-recovery/.

Updated California Invasive Plant Council Inventory

The California Invasive Plant Council (Cal-IPC) completed their update to California's list of invasive plants in 2017 following an extensive peer-review process and public comment period. This effort resulted in 10 species being added to the invasive plant list, bringing the total number of species on the list to 223. Cal-IPC also developed a list of 86 "watch" plants (of 196 that were evaluated), which are species considered high risk for becoming invasive in the future. The revised invasive plant listing, including "watch" species, can be found at http://www.cal-ipc.org/plants/inventory/#inventory.

The 10 new invasive plant species are:

- *Carrichtera annua*, Wards weed – Moderate, Alert
- *Chrysanthemoides monilifera* ssp. *monilifera*, boneseed – Moderate, Alert
- *Clematis vitalba*, old man's beard – Moderate, Alert
- *Colocasia esculenta*, taro root – Moderate, Alert
- *Geranium purpureum*, little robin - Limited
- *Ligustrum lucidum*, glossy privet - Limited
- *Limonium duriusculum*, European sea lavendar - Moderate
- *Mesembryanthemum nodiflorum*, slenderleaf iceplant - Limited
- *Tribulus terrestris*, puncturevine - Limited
- *Volutaria tubuliflora*, desert knapweed – Limited, Alert

Central Sierra Post-Tree Mortality Invasive Plant Control

The California Department of Food and Agriculture and Cal-IPC have implemented a program in cooperation with eight central Sierra county agricultural commissioner offices to address invasive plant populations that threaten to spread in areas that experienced high levels of tree mortality from the recent drought and associated bark beetle infestations (2011-2017). Along with on-the-ground control of locally-identified high-priority invasive plant populations, the project will disseminate information on best management practices to tree care professionals and landowners for preventing the spread of invasive plants after tree removal work.

US Forest Service Pacific Southwest Region (Region 5) Invasive Plant Data on Calflora

The US Forest Service, Pacific Southwest Region (R5) worked with Cal-IPC to upload 2016 National Forest invasive plant location data to the online Calflora database, which together with CalWeedMapper enables land managers to develop regional early eradication strategies. The timeline for the 2017 R5 data upload is set for spring of 2018. Calflora has also been promoting the use of the new “email alert” system which allows users to receive regular updates on new observations of selected plant species in selected regions.

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The California Forest Pest Council (CFPC), a 501(c)(3) non-profit organization, was founded in 1951 as the California Forest Pest Control Action Council. Membership is open to public and private forest managers, foresters, silviculturists, entomologists, plant pathologists, biologists, and others interested in the protection of California's urban and wildland forests from injury caused by biotic and abiotic agents. The Council's objectives are to establish, maintain, and improve communication among individuals who are concerned with these issues. These objectives are accomplished by:

1. Coordinating the detection, reporting, and compilation of pest injury, primarily from forest insects, diseases, and animal damage.
2. Evaluating pest conditions, primarily those of forest insects, diseases, and animal damage.
3. Making recommendations on pest control to forest managers, protection agencies, and forest landowners.
4. Reviewing policy, legal, and research aspects of forest pest management and submitting recommendations to appropriate authorities.
5. Fostering educational work on forest pests and forest health.

The California Board of Forestry and Fire Protection recognizes the Council as an advisory body in forest health protection, maintenance, and enhancement issues. The Council is a participating member in the Western Forest Pest Committee of the Western Forestry and Conservation Association.

This report was prepared by Forest Health Protection, US Forest Service, Pacific Southwest Region and the California Department of Forestry and Fire Protection with other member organizations of the Council.

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Cover Photo
Continuing but declining western pine beetle activity at Sugar Pine Reservoir, Tahoe NF. Photo by: D. Cluck, USFS

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